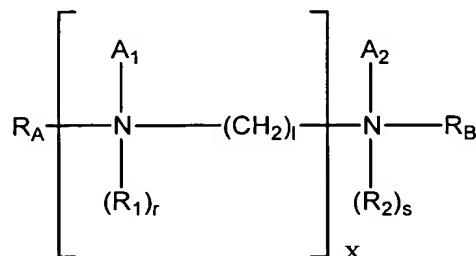


## CLAIMS

We claim:

1. A compound or polycation having the formula:



or salt thereof where:

x is an integer ranging from 1 to about 20;

l is an integer ranging from 1 to about 6;

r and s, independently of one another, are 0 or 1, wherein when r is 1, the N bonded to  $R_1$  and  $A_1$  has a positive charge, and when s is 1, the N bonded to  $R_2$  and  $A_2$  has a positive charge;

$R_A$  and  $R_B$ , independently of one another, are selected from the group consisting of H, or an alkyl, hydroalkyl or thiol-substituted alkyl group having from 1 to 6 carbon atoms;

$R_1$  and  $R_2$ , independently of one another, are selected from the group consisting of alkyl groups having 1 to about 6 carbon atoms; and

$A_1$  and  $A_2$ , independently of other  $A_1$  and  $A_2$  groups, are selected from the group consisting of a  $-\text{CH}(\text{D}-\text{L})_2$  and a  $-\text{C}(\text{D}-\text{L})_3$  group wherein D is selected from the group consisting of  $-\text{CO}-$ ,  $-\text{CO}_2-$ ,  $-\text{O}-\text{C}-\text{O}-$ ,  $-\text{CO}-\text{N}-$ ,  $-\text{O}-\text{CO}-\text{N}-$ ,  $-\text{O}-$ , and  $-\text{S}-$ , and L is selected from the group consisting of:

- (a) a straight chain or branched alkyl, alkenyl, or alkynyl group having from 2 to about 22 carbon atoms wherein one or more non-neighboring  $-\text{CH}_2-$  groups can be replaced with an O or S atom;
- (b) a substituted straight chain or branched alkyl, alkenyl, or alkynyl group having from 2 to about 22 carbon atoms wherein the substituent is an aromatic, alicyclic

heterocyclic or polycyclic ring and wherein one or more of the non-neighboring neighboring  $-CH_2-$  groups of said alkyl, alkenyl or alkynyl group can be substituted with an O or S atom; and

(c) an aromatic, alicyclic, heterocyclic and a polycyclic ring moiety.

5

2. The compound or polycation of claim 1 wherein L is selected from the group consisting of a straight chain or branched alkyl, alkenyl, or alkynyl group having from 2 to about 22 carbon atoms wherein one or more non-neighboring  $-CH_2-$  groups can be replaced with an O or S atom.

10

3. The compound or polycation of claim 1 wherein L is selected from the group consisting of a substituted straight chain or branched alkyl, alkenyl, or alkynyl group having from 2 to about 22 carbon atoms wherein the substituent is an aromatic, alicyclic heterocyclic or polycyclic ring and wherein one or more of the non-neighboring neighboring  $-CH_2-$  groups of said alkyl, alkenyl or alkynyl group can be substituted with an O or S atom.

15

4. The compound or polycation of claim 1 wherein L is selected from the group consisting of an aromatic, alicyclic, heterocyclic and a polycyclic ring moiety.

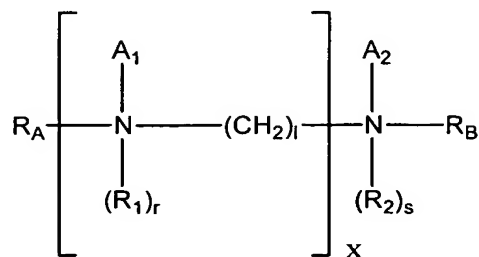
20

5. A lipid aggregate which comprises one or more compounds of claim 1.

6. A method for delivery of a macromolecule to a cell comprising the step of contacting said cell with a composition which comprises the compound of claim 1 and said macromolecule.

25

7. A compound or polycation having the formula:



or salt thereof where:

x is an integer ranging from 1 to about 20;

l is an integer ranging from 1 to about 6;

5 r and s, independently of one another, are 0 or 1, wherein when r is 1, the N bonded to R<sub>1</sub> and A<sub>1</sub> has a positive charge, and when s is 1, the N bonded to R<sub>2</sub> and A<sub>2</sub> has a positive charge;

R<sub>A</sub> and R<sub>B</sub>, independently of one another, are selected from the group consisting of H, or an alkyl, hydroalkyl or thiol-substituted alkyl group having from 1 to 6 carbon atoms;

10 R<sub>1</sub> and R<sub>2</sub>, independently of one another, are selected from the group consisting of alkyl groups having 1 to about 6 carbon atoms; and

15 A<sub>1</sub> and A<sub>2</sub>, independently of other A<sub>1</sub> and A<sub>2</sub> groups, are selected from the group consisting of a B-L group wherein B is selected from the group consisting of -CO-, -CO<sub>2</sub>-, -O-C-O-, -CO-N-, -O-CO-N-, -O-CH<sub>2</sub>-, -S-CH<sub>2</sub>-, -CH<sub>2</sub>-S-, and -CH<sub>2</sub>- and L is selected from the group consisting of:

(a) a straight chain or branched alkyl, alkenyl, or alkynyl group having from 2 to about 22 carbon atoms wherein one or more non-neighboring -CH<sub>2</sub>- groups can be replaced with an O or S atom;

20 (b) a substituted straight chain or branched alkyl, alkenyl, or alkynyl group having from 2 to about 22 carbon atoms wherein the substituent is an aromatic, alicyclic heterocyclic or polycyclic ring and wherein one or more of the non-neighboring neighboring -CH<sub>2</sub>- groups of said alkyl, alkenyl or alkynyl group can be substituted with an O or S atom; and

25 (c) an aromatic, alicyclic, heterocyclic and a polycyclic ring moiety.

8. The compound or polycation of claim 7 wherein L is selected from the group consisting of a straight chain or branched alkyl, alkenyl, or alkynyl group having from 2 to about 22 carbon atoms wherein one or more non-neighboring -CH<sub>2</sub>- groups can be replaced with an O or S atom.

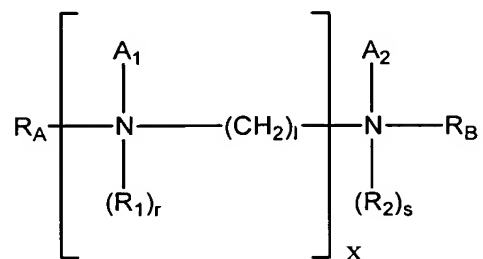
9. The compound or polycation of claim 7 wherein L is selected from the group consisting of a substituted straight chain or branched alkyl, alkenyl, or alkynyl group having

from 2 to about 22 carbon atoms wherein the substituent is an aromatic, alicyclic heterocyclic or polycyclic ring and wherein one or more of the non-neighboring neighboring  $-\text{CH}_2-$  groups of said alkyl, alkenyl or alkynyl group can be substituted with an O or S atom.

10. The compound or polycation of claim 7 wherein L is selected from the group consisting of an aromatic, alicyclic, heterocyclic and a polycyclic ring moiety.

11. A method for delivery of a macromolecule to a cell comprising the step of contacting said cell with a composition which comprises the compound of claim 7 and said macromolecule.

12. A compound or polycation having the formula:



or salt thereof where:

x is an integer ranging from 1 to about 20;

l is an integer ranging from 1 to about 6;

r and s, independently of one another, are 0 or 1, wherein when r is 1, the N bonded to  $\text{R}_1$  and  $\text{A}_1$  has a positive charge, and when s is 1, the N bonded to  $\text{R}_2$  and  $\text{A}_2$  has a positive charge;

$\text{R}_\text{A}$  and  $\text{R}_\text{B}$ , independently of one another, are selected from the group consisting of H, or an alkyl, hydroalkyl or thiol-substituted alkyl group having from 1 to 6 carbon atoms;

$\text{R}_1$  and  $\text{R}_2$ , independently of one another, are selected from the group consisting of alkyl groups having 1 to about 6 carbon atoms; and

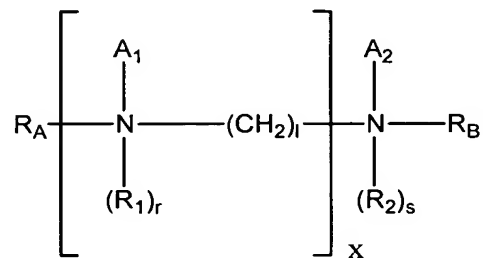
$\text{A}_1$  and  $\text{A}_2$ , independently of other  $\text{A}_1$  and  $\text{A}_2$  groups, are selected from the group consisting

of a substituted straight chain or branched alkyl, alkenyl, or alkynyl group having from 2 to about 22 carbon atoms wherein the substituent is an aromatic, alicyclic heterocyclic or polycyclic ring and wherein one or more of the non-neighboring neighboring  $-\text{CH}_2-$  groups of said alkyl, alkenyl or alkynyl group can be substituted with an O or S atom.

13. The compound or polycation of claim 12 wherein A1 and A2, independently of other A1 and A2 groups, are selected from the group consisting of a substituted straight chain or branched alkyl group having from 2 to about 22 carbon atoms wherein the substituent is an aromatic, alicyclic heterocyclic or polycyclic ring and wherein one or more of the non-neighboring neighboring  $-\text{CH}_2-$  groups of said alkyl group can be substituted with an O or S atom.

14. A method for delivery of a macromolecule to a cell comprising the step of contacting said cell with a composition which comprises the compound of claim 12 and said macromolecule.

15. A compound or polycation having the formula:



or salt thereof where:

x is an integer ranging from 1 to about 20;

l is an integer ranging from 1 to about 6;

r and s, independently of one another, are 0 or 1, wherein when r is 1, the N bonded to R<sub>1</sub> and A<sub>1</sub> has a positive charge, and when s is 1, the N bonded to R<sub>2</sub> and A<sub>2</sub> has a positive charge;

R<sub>A</sub> and R<sub>B</sub>, independently of one another, are selected from the group consisting of H, or an alkyl, hydroalkyl or thiol-substituted alkyl group having from 1 to 6 carbon atoms;

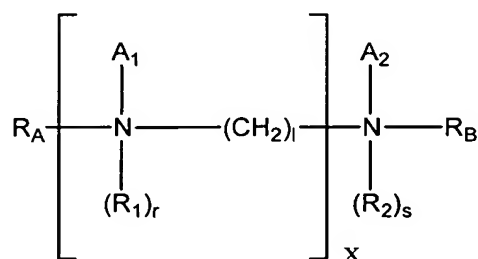
R1 and R2, independently of one another, are selected from the group consisting of alkyl groups having 1 to about 6 carbon atoms; and

A1 and A2, independently of other A1 and A2 groups, are selected from the group consisting of a straight chain or branched alkyl, alkenyl, or alkynyl group having from 2 to about 22 carbon atoms wherein one or more of the non-neighboring neighboring  $-\text{CH}_2-$  groups of said alkyl, alkenyl or alkynyl group can be substituted with an O or S atom.

16. The compound or polycation of claim 15 wherein A1 and A2, independently of other A1 and A2 groups, are selected from the group consisting of a straight chain or branched alkyl group having from 2 to about 22 carbon atoms wherein one or more of the non-neighboring neighboring  $-\text{CH}_2-$  groups of said alkyl group can be substituted with an O or S atom.

17. A method for delivery of a macromolecule to a cell comprising the step of contacting said cell with a composition which comprises the compound of claim 15 and said macromolecule.

18. A compound or polycation having the formula:



or salt thereof where:

x is an integer ranging from 1 to about 20;

l is an integer ranging from 1 to about 6;

r and s, independently of one another, are 0 or 1, wherein when r is 1, the N bonded to  $\text{R}_1$  and  $\text{A}_1$  has a positive charge, and when s is 1, the N bonded to  $\text{R}_2$  and  $\text{A}_2$  has a positive charge;

R<sub>A</sub> and R<sub>B</sub>, independently of one another, are selected from the group consisting of H, or an alkyl, hydroalkyl or thiol-substituted alkyl group having from 1 to 6 carbon atoms;

5 R<sub>1</sub> and R<sub>2</sub>, independently of one another, are selected from the group consisting of alkyl groups having 1 to about 6 carbon atoms; and

10 A<sub>1</sub> and A<sub>2</sub>, independently of other A<sub>1</sub> and A<sub>2</sub> groups, are selected from the group consisting of a straight chain or branched alkyl group substituted with one or two SH groups within about 3 carbon atoms of the bond between A<sub>1</sub> or A<sub>2</sub> and N.

19. The compound or polycation of claim 18 wherein the A<sub>1</sub> and A<sub>2</sub> groups have from 2 to about 22 carbon groups.

15 20. A method for delivery of a macromolecule to a cell comprising the step of contacting said cell with a composition which comprises the compound of claim 18 and said macromolecule.